

# UK Patent Application

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(56) Documents cited

GB 2233737 A  
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(58) Field of search  
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INT CL<sup>5</sup> F16K

## (54) A check valve assembly

(57) A check valve assembly comprises a two-part housing (21, 22) in which are located two non-return valve inserts (2, 3) which are disposed in series along the axis of the housing. Each of the valve inserts (2, 3) comprises a fixed unit (8, 9, 10) which abuts a portion of the housing (1) and an axially displaceable member (6) which is spring-biassed to engage a valve seat (11) formed by a portion (10) of the fixed unit (8, 9, 10). The valve inserts (2, 3) are spaced from one another and retained in position within the housing by means of an annular spacer (4) which abuts at least one of the fixed units (8, 9, 10) of the two valve inserts (2, 3) in opposition to its abutment of the housing. Preferably, the spacer (4) can slide axially with respect to the housing so that when liquid is flowing through the valve, pressure on the spacer (4) forces it to slide into contact with the fixed unit of the downstream valve insert (3) in opposition to its abutment of the housing. Alternatively the spacer (4) is resilient and abuts the fixed units of both valve inserts (2, 3) in opposition to their abutment of the housing.

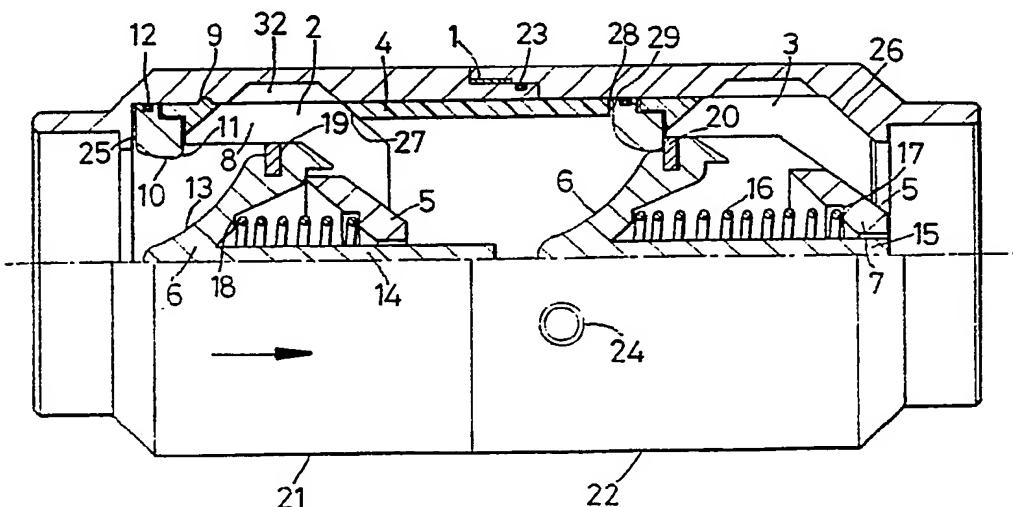


Fig.1

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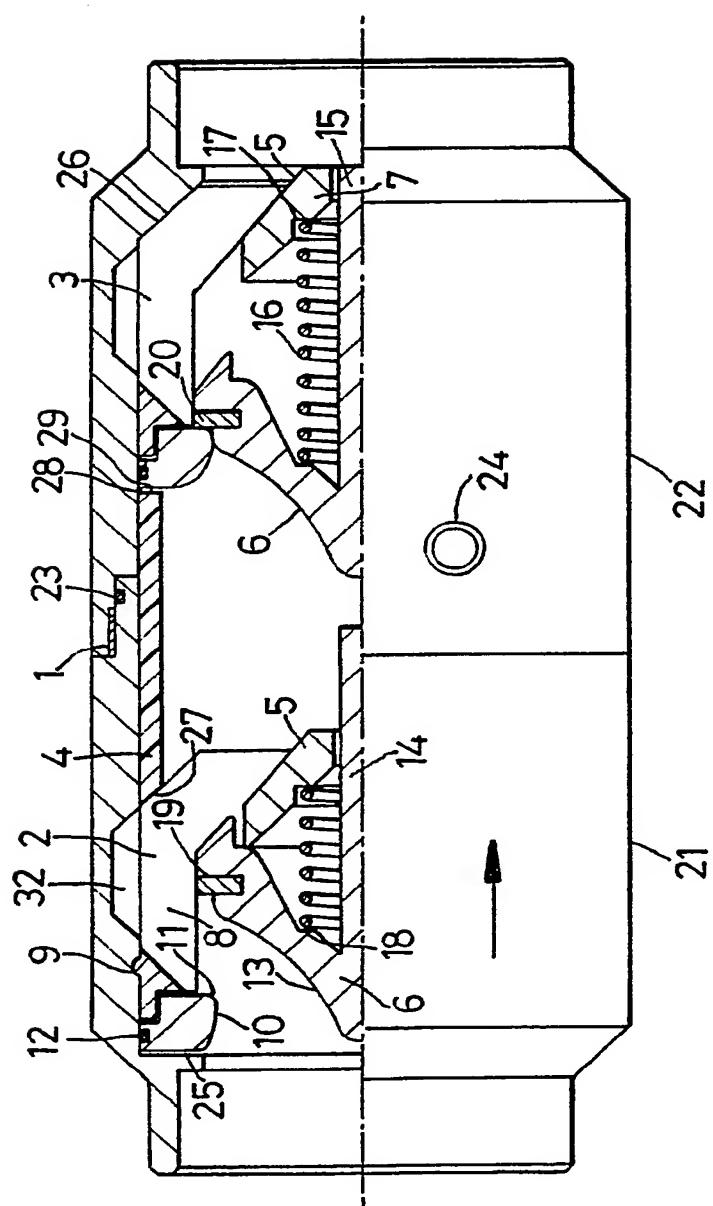


Fig. 1

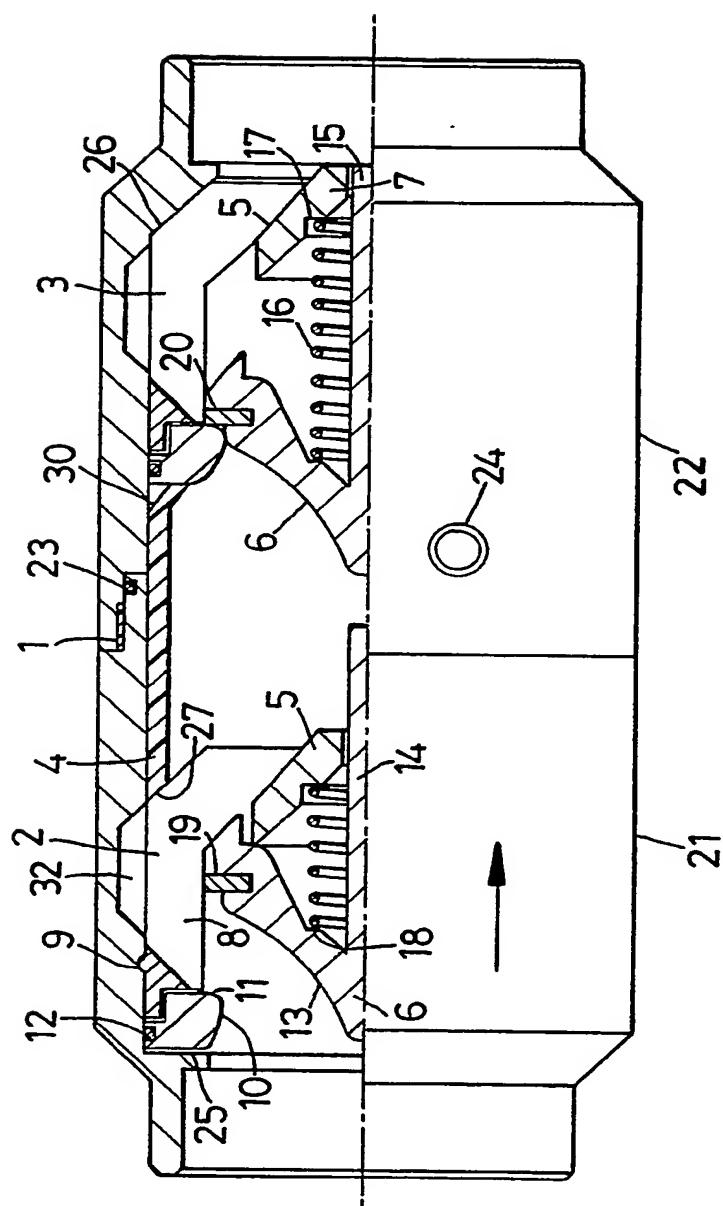


Fig. 2

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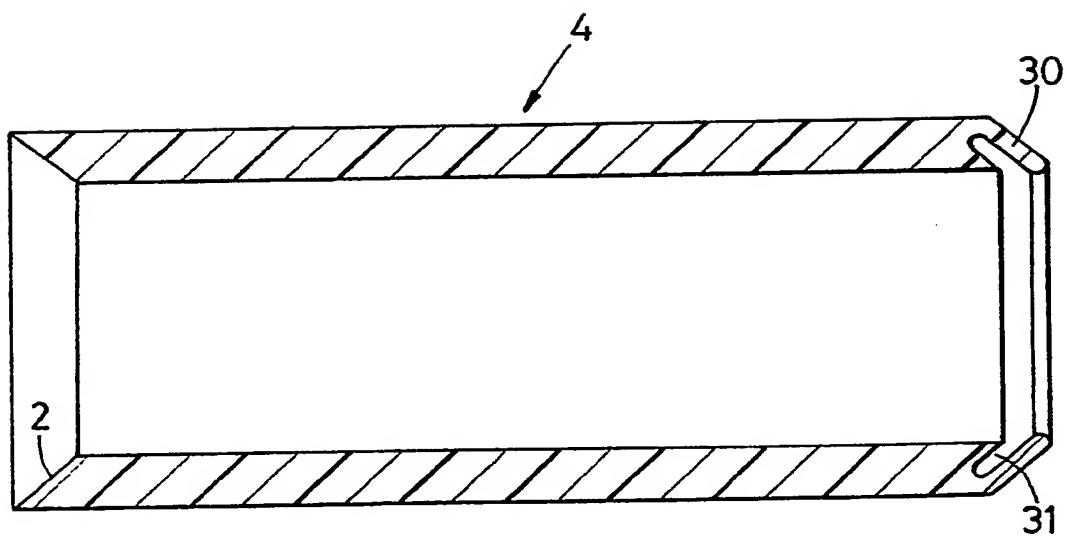


Fig.3

A CHECK VALVE

The present invention relates to a check valve or non-return valve and in particular to a double check valve wherein two check or non-return valves are located in series in a casing so that one can provide a back-up for the other.

Check valves are used in many applications but it is now a legal requirement in the United Kingdom for double check valves to be used in the supply of mains water at all outlets, including stand pipes, to prevent contamination of the mains supply. Conventional double check valves comprise two separate check valve inserts located in series in a one-part housing, the inserts being retained in position by means of circlips or the like. The disadvantage of this arrangement is that if one or both of the valves becomes clogged or jammed or otherwise requires maintenance, it is difficult to gain access to the valves either to clear the blockage or to replace damaged components. Usually, therefore, the whole double check valve unit is replaced. This is both costly and wasteful in most instances.

It is an object of the present invention to overcome or substantially mitigate the aforementioned disadvantage.

According to the present invention there is provided a valve comprising a housing in which is located two non-return valves which are disposed in series along the axis of the housing, each of the non-return valves comprising a fixed member which abuts a portion of the housing and an axially displaceable member which is spring-biassed to engage a valve seat formed by a portion of the fixed member, the non-return valves being spaced from one another and retained in position within the housing by

means of an annular spacer which can abut at least one of the fixed members of the two non-return valves in opposition to its abutment of the housing.

Preferably, the housing is in two parts which are releasably joined together annularly adjacent the position of the spacer.

Preferably also, when one end of the spacer is in contact with one of the fixed members of the two non-return valves, a small gap is defined between the other end of the spacer and the fixed members of the other non-return valve to accommodate tolerances in the sizes of the various components of the non-return valves.

Preferably also, the gap is up to 0.75 mm in length.

Preferably also, the annular spacer can slide axially with respect to the housing so that when liquid is flowing through the valve, pressure on the spacer forces it into contact with one of the fixed members of the downstream non-return valve in opposition to its abutment of the housing.

Alternatively, the annular spacer is resilient and abuts the fixed members of both of the two non-return valves in opposition to their abutment of the housing.

Preferably also, the resilient annular spacer comprises a flexible annular lip at one end which abuts one of the fixed members and which is compressible to accommodate tolerances in the sizes of the various components of the non-return valves.

The present invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a view of a first embodiment of a valve according to the invention in part longitudinal section to reveal its construction;

Figure 2 is a view similar to Figure 1 but of a second embodiment of a valve according to the invention; and

Figure 3 is a longitudinal sectional view of a modified annular spacer for use in the valve shown in Figure 2 but shown to a larger scale.

The valves shown in Figures 1 and 2 are double check valves each comprising a housing 1 in which is located two non-return valve inserts 2 and 3. The inserts 2 and 3 are identical in construction, as will be described, and are located in series along the longitudinal axis of the housing 1, being spaced from one another by means of an annular spacer 4. In Figure 1, the insert 2 is shown in a valve open position and the insert 3 is shown in a valve closed position.

The valve inserts 2 and 3 each comprise self-contained units which are manufactured individually, mainly of plastics materials, and then located in the housing 1 along with a spacer 4 when the valve of the invention is assembled.

Each of the inserts 2 and 3 comprises a member 5 which is fixed in position with regard to the housing 1 and a moveable member 6 which can be displaced axially with regard to the housing 1 and the member 5. The fixed

member 5 comprises a substantially conical annular portion 7 which is provided with a series of outwardly projecting radial fins 8. The fins 8 are connected to an annulus 9 which contacts the interior surface of the housing 1 and which is snap-fitted to a sealing ring 10. The sealing ring 10 projects inwardly of the annulus 9 and defines a shoulder forming a valve seat 11. An annular groove 12 is formed in the outer surface of the sealing ring 10 to accommodate an O-ring seal which bears against the interior surface of the housing 1.

The moveable members 6 of the valve inserts 2 and 3 comprise a substantially conical valve member 13 connected to a rod 14 which is guided in an axial bore 15 formed in the portion 7. A spring 16 is located around the rod 14 and bears against shoulders 17 and 18, formed on the interior surfaces of the portion 7 and the member 13 respectively, to urge a sealing washer 20 carried against a shoulder 19 formed on the member 13 into contact with the seat 11.

The housing 1 is formed in two parts 21 and 22 which are screwed together in a position between the two valve inserts 2 and 3 opposite the position of the spacer 4. To ensure that this joint does not leak, the male portion of the joint is provided with an annular groove 23 in which is located an O-ring seal. In addition, after the two parts 21 and 22 have been connected together, three small holes are tapped into both parts of the joint and grub screws inserted to prevent the two parts 21 and 22 of the housing from being unintentionally unscrewed during attachment or detachment of the valve to a stand pipe or other water pipe.

Other conventional means of releasably locking the two parts 21 and 22 of the housing together after assembly of the valve can also be employed.

One of the parts 21 or 22 of the housing 1 can also be provided with a test port 24, as shown in part 22 in Figure 1. The provision of this port 24 is a requirement of the United Kingdom Water Authorities if the valve is for use in the supply of mains water so that an inspection of the valve can be made *in situ* without it having to be dismantled. To this end, the spacer 4 is also provided with an orifice located in line with the port 24.

In use, the part 21 is located up-stream of the part 22 and is provided with an interior annular shoulder 25, which extends radially and against which the sealing ring of the insert 2 abuts. In contrast, the part 22 is provided with an annular shoulder 26, which tapers in the direction of fluid flow through the valve and against which a similarly tapering portion of the fins 8 of the fixed member 5 of the insert 3 bears.

The inserts 2 and 3 are spaced apart and retained in position by means of the spacer 4, which comprises an annular member, preferably made of a resilient non-metallic material.

In a first embodiment as shown in Figure 1, one end 27 of the spacer 4 abuts the fixed members 5 of the insert 2 in opposition to its abutment of the housing 1. However, a small gap 28 of approximately 0.5 mm and no more than 0.75 mm is left between the fixed members 5 of the insert 3 and the other end 29 of the spacer 4 to accommodate tolerances in the sizes of the various components of the non-return valves.

The spacer 4 can slide axially with respect to the housing 1 so that when liquid, usually water, is flowing through the valve in the direction of the arrow, pressure on the spacer 4 forces it to slide away slightly away from the insert 2 and into contact with the sealing ring 10 of the insert 3, which is downstream of the insert 2. For this purpose, whereas the end 27 of the spacer 4 tapers inwardly in a similar way to the annular shoulder 26 so that it can bear against the fins 8 of the fixed member 5 of the insert 2, the other end 29 of the spacer 4 is flat so that it can make good contact with the sealing ring 10 of the insert 3 in order to retain the insert 3 in position in opposition to its abutment of the housing 1 when required.

In the second embodiment as shown in Figure 2, the spacer 4 is provided with a flexible annular lip 30 at one end which abuts the sealing ring 10 of the insert 3. The lip 30 is compressible to permit the overall length of the spacer 4 to vary slightly to accommodate tolerances in the sizes of the various components of the non-return valves and slight variations in size which occur owing to differing coefficients of expansion of the materials of the various components of the inserts 2 and 3.

As shown in Figure 2, the lip 30 is formed by an annular rim at one end of the spacer 4, the interior diameter of which end increases gradually towards the lip so that the lip 30 does not project radially beyond the inner surface of the other end of the spacer 4. However, in a modification, as shown in Figure 3, the interior diameter of the spacer 4 is constant and the lip 30 is formed by the formation of an annular groove or notch 31 at the inner end of the spacer 4.

As before, the end 27 of the spacer 4 opposite the lip 30 tapers inwardly in a similar way to the annular shoulder 26 so that it can bear against the fins 8 of the fixed member 5 of the insert 2.

In both the first and second embodiments, the spacer 4 also bears against the interior surface of the housing 1 for at least part of its length.

In order to cause as little loss of flow capacity and head loss through the valve as possible as a result of the volume taken up by the components of the inserts 2 and 3, the interior surface of the housing 1 at the location of the fins 8 of both of the inserts 2 and 3 is machined away, as at 32, so that the diameter here is greater than the internal diameter of the rest of the housing 1 and than the fins 8 and other fixed members of the inserts 2 and 3.

When the valve of the invention is assembled, it will be appreciated that all that is required is to locate the separately manufactured valve inserts 2 and 3 into the respective parts 21 and 22 of the housing 1 and to locate the spacer 4 so that it abuts at least the insert 2 in the correct position over the test port orifice 24 before joining the two parts 21 and 22 together as previously described. The valve can then be used and located in a stand pipe or in any other location where a double check valve is required.

Because of the way in which the valve is constructed, should it require maintenance or servicing, the two parts 21 and 22 of the housing can be disconnected, if necessary the spacer 4 removed, and the valve inserts 2 and 3 seen to with easy of access. In addition, either of the valve

inserts 2 and 3 can simply be lifted out and either serviced or replaced without difficulty and without any special tools being required.

Whilst the aforementioned example is described with particular emphasis on its use in the supply of mains water, it will be appreciated that the invention can be employed in any situation where a double check or non-return valve is required.

CLAIMS

1. A valve comprising a housing in which is located two non-return valves which are disposed in series along the axis of the housing, each of the non-return valves comprising a fixed member which abuts a portion of the housing and an axially displaceable member which is spring-biassed to engage a valve seat formed by a portion of the fixed member, the non-return valves being spaced from one another and retained in position within the housing by means of an annular spacer which can abut at least one of the fixed members of the two non-return valves in opposition to its abutment of the housing.
2. A valve as claimed in Claim 1, wherein the housing is in two parts which are releasably joined together annularly adjacent the position of the spacer.
3. A valve as claimed in Claim 1 or Claim 2, wherein when one end of the spacer is in contact with one of the fixed members of the two non-return valves, a small gap is defined between the other end of the spacer and the fixed member of the other non-return valve to accommodate tolerances in the sizes of the various components of the non-return valves.
4. A valve as claimed in Claim 3, wherein the gap is up to 0.75 mm in length.
5. A valve as claimed in Claim 3 or Claim 4, wherein said one end of the resilient annular spacer is shaped to conform to the profile of that portion of the fixed member of the non-return valve with which it is in contact.

6. A valve as claimed in any one of Claims 3 to 5, wherein the annular spacer can slide axially with respect to the housing so that when liquid is flowing through the valve, pressure on the spacer forces it to slide into contact with the fixed member of the downstream non-return valve in opposition to its abutment of the housing.

7. A valve as claimed in Claim 1 or Claim 2, wherein the annular spacer is resilient and abuts the fixed members of both of the two non-return valves in opposition to their abutment of the housing.

8. A valve as claimed in Claim 7, wherein the resilient annular spacer comprises a flexible annular lip at one end which abuts one of the fixed members and which is compressible to accommodate tolerances in the sizes of the various components of the non-return valves.

9. A valve as claimed in Claim 8, wherein the flexible lip bears against the valve seat formed by the fixed member of one non-return valve, the valve seat formed by the fixed member of the other non-return valve abutting a shoulder defined by the interior surface of the housing.

10. A valve as claimed in Claim 8 or Claim 9, wherein the other end of the resilient annular spacer is shaped to conform to the profile of that portion of the fixed member of the non-return valve with which it is in contact.

11. A valve as claimed in any one of Claims 1 to 10, wherein the spacer bears against the interior surface of the housing for at least part of its length.

12. A valve as claimed in any one of Claims 1 to 11, wherein the displaceable members of the two non-return valves are provided with annular seals which abut their respective valve seats.
13. A valve as claimed in any one of Claims 1 to 12, wherein the internal diameter of part of the housing at the location of the fixed members is greater than the diameter of the fixed members to prevent loss of flow capacity through the valve as a result of the volume taken up by the components of the non-return valves.
14. A valve substantially as described herein with reference to Figure 1 or Figures 2 and 3 of the accompanying drawings.

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**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

Application number

GB 9221611.8

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|--|------------------------|
| <b>Relevant Technical fields</b>               | <b>Search Examiner</b> |
| (i) UK CI (Edition K ) F2W (VA17 VA22 VP3 VR4) |                        |
| (ii) Int CI (Edition 5 ) F16K                  | PAM HYETT              |
| <b>Databases (see over)</b>                    | <b>Date of Search</b>  |
| (i) UK Patent Office                           |                        |
| (ii)   | 16 NOVEMBER 1992       |

Documents considered relevant following a search in respect of claims 1-14

| Category<br>(see over) | Identity of document and relevant passages |                        | Relevant to<br>claim(s) |
|------------------------|--|------------------------|-------------------------|
| A                      | GB 2233737 A                               | (WIGLEY) see Figure 8  |                         |
| X                      | US 4862907                                 | (LEDTJE) see spacer 32 | 1, 11, 13               |
| X                      | US 4139469                                 | (RAININ) see washer 60 | 1, 7, 11, 13            |
| X                      | US 4013088                                 | (GOCKE) see spring 10  | 1, 7, 12, 13            |

| Category | Identity of document and relevant passages | Relevant to claim(s) |
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